

# MARINE SCIENCE

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Paper 5180/01  
Structured

## Key Messages

In questions where the answer is a numerical one the units should always be stated except where they are printed on the answer line.

Where questions specify a particular number of responses, e.g. one or two then only the number required should be given. Additional responses can lead to loss of credit.

Where it is necessary to change an answer do not overwrite the original. Cross it out neatly.

Take careful note of the mark allocation and the number of lines given for the answer. This is a good indication of the length of the response required.

## General Comments

Good answers are typified by clear and precise use of language.

### Question 1

(a) (i) This part of the question was generally well answered and most candidates gained most of the available credit. Candidates usually correctly identified the bony fish (F) but some then misidentified the other organisms.

#### (ii), (iii) and (iv)

Animals B and C were generally correctly identified, but some candidates were unsure of the term "carapace" and therefore found identifying the arthropods group in part (iv) a challenge.

### Question 2

(a) Many candidates were able to state the role of carbohydrates and many correctly described the role of lipids. Fewer candidates were able to describe the uses of protein, and a minority of the candidates correctly described the function of nucleic acids. Often candidates described nucleic acids as controlling the cell, or wrote "for energy". Precise language was required in the answers; "helps in respiration" was not precise enough to gain credit as a use for carbohydrate.

#### (b) (i) and (ii)

Candidates discussed deficiency diseases as opposed to the actual use of the vitamin. Credit could not be awarded for this response. Common misconceptions involved other vitamins such as C and K. "Blood clotting" was commonly quoted as the use of vitamin D in a balanced diet.

### Question 3

- (a) (i) A large proportion of candidates omitted the unit, so credit was not awarded.
- (ii) Candidates must include units to gain credit. Candidates found the calculation challenging.
- (iii) On the whole, this part of the question was well answered and many candidates were able to describe the relationship between age and mass. Some candidates defined mass and age and did not describe the link between them.
- (b) The most common acceptable answers referred to food, temperature and oxygen. Some candidates described these negatively (lack of food) and others simply gave the factor; both of these were awarded credit.
- (c) It was clear that many candidates had a good knowledge of the advantages of shoaling and these candidates often gave very detailed answers including references to hydrodynamic efficiency, feeding advantages, reproductive advantages and protection from predators. Some candidates described the advantage to fishermen of fish being in shoals.

### Question 4

- (a) (i) Most candidates appreciated that aquaculture involves the rearing of aquatic organisms. This was often couched in various ways, such as, "breeding", "farming" or "cultivation".
- (ii) This part of the question was generally well answered with many candidates referring to there being no need for expensive gear and the faster growth or increased yield from stock. In addition, the greater predictability of yield and reduced health risk to consumers was also often quoted. Some candidates referred to fewer costs without further qualification of their response.
- (iii) The most common disadvantage of aquaculture given by candidates was the reference to the need for a large land area needed in some instances.
- (b) (i) Candidates found the calculation challenging.
- (ii) This calculation proved challenging for most candidates and correct calculations were rare.
- (c) Answers frequently referred to the need for food, light and oxygen; stronger candidates gave three acceptable ideas in their account of the intensive system of aquaculture.

### Question 5

- (a) Some candidates were unclear about the definitions of tides and upwelling and it was difficult to identify which was being described.
- (b) (i) Many candidates were able to suggest how upwelling can affect sea temperatures.
- (ii) Fewer candidates were able to suggest how upwelling can affect productivity. Those who referred to increased productivity often linked this to the increased availability of nutrients for the phytoplankton.
- (c) All parts of the question were generally well done.

### Question 6

- (a) (i) Stronger candidates appreciated that flooding the bait hold with sea water would remove waste and help to oxygenate the water in the hold.
- (ii) Candidates found this question challenging; with few candidates suggesting that the fish should be kept in the bait hold for a minimum time was to prevent stress, the spread of disease or physical damage.
- (iii) Candidates confused the need for low water temperature in the holding tank with reducing spoilage or bacterial activity, as if the fish were dead rather than being exported live.
- (iv) There were some good answers in this part of the question referring to higher prices, more profit or increased demand.

### Question 7

- (a) The question asked for properties of aluminium which made it suitable for boatbuilding. Candidates frequently referred to aluminium boats “going faster” or being able to “hold more people”; neither of these are properties of aluminium so could not be awarded credit. “Lightness” was common response; candidates should use scientific terminology such as having a (relatively) low density. A few referred to malleability and some described durability.
- (b) Those who knew what seamanship is frequently were awarded full credit in this part.
- (c) Most candidates scored partial credit in this part usually gaining credit for the last two methods. “Purse seine” and “Otter trawl” were often confused. The stronger candidates gained full credit.
- (d) (i) This proved to be very straightforward and almost all candidates gained credit.  
(ii) The calculation of the difference in the mean daily catch between the two countries was recorded correctly but many candidates omitted the unit so did not gain credit.

### Question 8

- (a) Almost all the candidates were able to identify the two parts of the Earth as labelled on the diagram.
- (b) Parts (i), (ii) and (iii) were well answered with many candidates able to identify the appropriate parts of the diagram.
- (c) Several candidates believed nearshore to be well out to sea or part of the abyssal plain.

### Question 9

- (a) The concept of conservation was generally well known by some candidates. Many candidates re-used part of the word they were trying to define, thus answers incorporating the term “conservation involves “conserving...”” gained only partial credit for this part of the question.
- (b) (i) Very few candidates recognised that the question was about percentages rather than raw numbers.  
(ii) Almost all candidates completed the addition correctly.
- (c) This question generated some good answers incorporating valid ways in which endangered marine species can be protected ranging from prohibiting catching, references to quotas, gear restrictions and creation of appropriate laws were common themes in candidate’s responses.

**Question 10**

- (a) (i)** References to “price” was a frequent response, however, a unit was required to make the scale meaningful and to gain credit. Candidates who suggested a unit mainly chose dollars rather than the national currency.
- (ii)** Some candidates quoted the two months showing the highest and lowest price increases.
- (b)** Many candidates gained partial credit in this part of the question usually with references to supply and demand, the stronger candidates gained full credit, often by referring to the quality of the fish available. Very few candidates made reference to possible Government restrictions.

# MARINE SCIENCE

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Paper 5180/02

Paper 2

## Key Messages

Candidates should read the questions carefully, consider the “command words” used and note the mark allocation for each part, be careful to distinguish between *describe* and *explain*, select appropriate information to answer the questions, try to avoid including irrelevant material in the answers and use scientific terms and vocabulary. Candidates should also include units, where appropriate, with numerical answers and choose suitable scales for a graph and label the axes fully.

## General Comments

As a general rule, candidates performed better in **Questions 1, 3 and 4** than in **Question 2**. In **Section B**, **Question 4** was generally answered better than **Question 3**.

## Comments on Specific Questions

### **Section A**

#### **Question 1**

- (a) (i) The majority of candidates chose a suitable, linear scale and plotted the points carefully. Fewer candidates labelled both axes correctly and some did not join the points as directly, but drew freehand curves or attempted to draw a line of best fit.

When plotting a graph, candidates are expected to choose suitable, linear scales that use at least half of the grid provided, orientate the axes correctly and label them fully, with units where appropriate, plot the points accurately and join the points as instructed with extrapolating the line beyond the data points.

- (ii) Relatively few candidates described the trend in terms of an overall decrease in spawning stock biomass. Many of the answers gave a year-by-year description of the changes without identifying the trend.
- (iii) Relatively few candidates gave an acceptable explanation of the term *spawning stock biomass*, without repeating the wording of the question, for example, by stating that it is “the biomass of spawning fish”. Candidates were expected to indicate that biomass refers to the mass (or weight) of fish and that spawning stock refers to mature fish, or those that are capable of breeding. Some answers incorrectly referred to numbers of fish, or to fecundity.
- (b) (i) The majority of candidates correctly identified the year as 2005.
- (ii) Many candidates correctly identified plaice and haddock, although plaice and whiting were seen on a number of scripts.
- (iii) One common error was failing to qualify the figure given with appropriate units (thousands of tonnes). Some credit was given for quoting the figure of 200, but for full credit the units were also expected.
- (c) Candidates were expected to suggest reasons for the decrease in the spawning stock biomass for whiting. Answers including overfishing and references to food availability, disease or migration were given credit. Some candidates suggested a decrease in demand, or referred to the decrease in stock without giving any possible reasons.

## Question 2

There were some good answers to this question, although many candidates found it challenging.

- (a) Most candidates were able to give at least one possible advantage of producing salmon by aquaculture, although some answers were too vague to gain credit. For example, a simple statement such as “it is cheaper” should be qualified. Many answers referred to the increased yield, or predictable yield, or to the lack of need to expensive fishing boats. Relatively few answers referred to the impact of aquaculture on wild stock or to sustainability.
- (b) Candidates generally found interpreting the information given and suggesting the effect of parasitism on the yield of salmon challenging. A number of answers repeated the information, but did not explain why fish lice might decrease the yield of salmon, or suggested that fish lice are a source of food for salmon. Some answers gained partial credit for including a reference to the harmful effect of the parasite on its host, without suggesting what effect it might have on the yield.
- (c) (i) Many candidates found it difficult to calculate the means of the data given. Some of the answers were the totals, rather than the means. There were also a number of errors in rounding the answers.
- (ii) Many candidates gained credit for recognising that the mean concentration of pesticide residues is higher in salmon produced by aquaculture than it is in wild stock, but relatively few went on to quantify the difference or to suggest a valid reason for the difference. There were some good answers which stated the difference the mean values and indicated that the difference may be due to the use of pesticides to control parasites in aquaculture operations.
- (iii) The minority of candidates suggested economic considerations in the use of pesticides. A number of candidates correctly referred to the initial cost of pesticides, but many answers included irrelevant suggestions relating to environmental considerations or the toxic effect of pesticides.
- (d) A minority of candidates gave reasons why a high stocking density may reduce the yield of salmon. When credit was gained, it was typically for the idea of either susceptibility to disease or to physical injury to the fish.

## Section B

### Question 3

- (a) (i) This part was answered well and the majority of candidates correctly referred to stiffening of muscles, with some candidates also including the three stages of rigor. There were some answers that confused this process with spoilage in general or with the action of bacteria in putrefaction.
- (ii) This part was generally answered less well than part (a)(i), although many candidates correctly recognised the action of enzymes in autolysis.
- (iii) This part was usually answered successfully with reference to the oxidation of fats, some answers again referred to spoilage in general or to the consequences of rancidity, rather than the process itself.
- (iv) The majority of candidates recognised that bacteria are involved in putrefaction, but fewer candidates referred to their growth. As with other parts of this question, some answers described the consequences or effects of putrefaction.
- (b) Candidates were asked to *compare* the appearance of a fresh fish with a spoilt fish. It is essential, therefore, to give comparative features of each. Some candidates presented their answers in the form of a table, which clearly compared both fish. Other answers included a description of a fresh fish, followed by a description of a spoilt fish. In this case, candidates were given credit where corresponding features were described. There were some drawings of fresh and spoilt fish; credit was given, where possible, for appropriate annotations.

### Question 4

- (a) This part was answered well and the majority of candidates were able to gain some credit, usually for reference to the presence of a hold for the catch, or the presence of a baitwell. Candidates were expected to give specific features of a fishing boat; some of the structures named were those of boats in general, or simply listed three different types of construction materials.
- (b) There were some very good, detailed accounts of the sequence of events in a four-stroke diesel engine, with appropriate descriptions of the function of each stage. Candidates who named the four stages as induction (or intake), compression, power and exhaust and included at least one descriptive point for each stage frequently gained full credit. Some answers named some of the stages only, or compared diesel engines with petrol engines, sometimes confusing features of both. There were also some answers that described the advantages of diesel engines, but did not include references to the functioning.
- (c) There were also some good answers to this part, in which candidates readily gained full credit for explaining the principle of a fish aggregating device. These answers included references to the FAD as a floating object and described the associated food chain and why this attracted larger fish, such as tuna. Candidates were asked to explain the principle of the FAD, some answers included mostly irrelevant details of the structure, but may also have included an explanation of the principle.

# MARINE SCIENCE

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Paper 5180/03  
Practical Assessment Paper

## Key Messages

Candidates should read the questions carefully and note the “command words” and the mark allocation. They should be familiar with all the core practicals included in the syllabus. They need to use a sharp pencil for drawings and use a ruler when drawing a table. They should read values from graphs carefully, include units, where appropriate, with numerical answers and be careful when converting units from one form to another, for example mm to cm.

## General Comments

The questions relate to observations of specimens, descriptions of practical methods and presentation of results, designing and evaluation an investigation to test a hypothesis. There are many core practicals included in the syllabus and it is essential that candidates have first-hand experience of these to help answering related questions.

## Comments on Specific Questions

### Question 1

- (a) All candidates attempted this part. The standard of the drawings was variable. Candidates were asked to make their drawing the same size as the specimen **Figure 1.1** and the majority of candidates followed this instruction, although some drawings were too large. To assess the quality of the drawings, Examiners use four criteria, making the drawing the correct size, giving the correct proportions, with attention to, for example, the relationship between depth and length of the body and size of the caudal fin in relation to the body, neatly drawn lines with continuous rather than sketchy lines and the features of the specimen shown correctly, including some detail of the dorsal fin.

To gain full credit for the drawing, therefore, candidates should look carefully at the size and proportions of the specimen and to use these features as a guide for the drawing. A sharp pencil should be used. It is not necessary to shade the drawing; an accurate outline drawing is expected.

- (b) This part was generally answered well and most candidates were able to name at least four of the features correctly. One common error was labelling the pelvic fin as the pectoral fin.
- (c) (i) The scale line was more variable and sometimes omitted from the drawing. Candidates were expected to indicate the actual total length of the specimen as 22 cm, however, many indicated the length of their drawing rather than the actual specimen shown.
- (ii) This part was also variable. Candidates were given some credit if they correctly calculated the magnification of their drawing, rather than the specimen shown. The magnification should be shown as a figure only, for example “x 0.5” as the magnification does not have units.

### Question 2

- (a) (i) The phylum was named correctly by the majority of candidates, although the spelling was very variable. Candidates are generally given credit if the spelling is incorrect, provided that the word is recognisable and cannot be confused with another word.
- (ii) Candidates were expected to make comparisons between the features of the two specimens shown in **Figure 2.1**, rather than to use their knowledge. The majority made an acceptable



comparison between the shapes of the body of each specimen, such as “cylindrical” and “five pointed star shape”. The other features were compared more variably.

- (b) Parts (i) and (ii) were generally answered correctly and candidates read the values correctly from the graph.
- (c) There were some very good drawings of a hydrometer, with the parts labelled correctly, for which full credit was given. Some candidates drew a recognisable hydrometer, but did not label the scale although these may have been indicated on the drawing. Drawings of either an improvised hydrometer, or a purpose-made hydrometer were given credit.

### Question 3

- (a) (i) The majority of candidates were familiar with the iodine test for starch and named the reagent and correctly described the colour change.
- (ii) The answers to this part were more variable. The majority of candidates gained some credit for describing a test (using either Benedict’s reagent or Fehling’s A and B) for reducing sugars, but relatively few gave the additional details required for non-reducing sugars. Candidates who started with a description of acid hydrolysis, followed by the application of a test for reducing sugars, usually gained full credit.
- (b) A full range of responses was seen to this part. A number of candidates gained full credit for a detailed description of the displacement method to find the volume and then correctly indicated how the mean value would be obtained. However, there were some answers with descriptions of finding the mass and density of the fish. Where these accounts included some relevant points relating to the determination of density they were given credit where appropriate.

### Question 4

- (a) The tabulation of data was rather variable and although many candidates gained some credit, relatively few gained full credit. For this part, candidates were expected to draw a table with neat, ruled lines, include appropriate headings for each column, with full units for protein content and to rank the protein content.
- Units should be given in the column heading and not repeated in each row of data. Many candidates did not rank the protein content, but may have gained some credit for the other criteria.
- (b) This part was generally answered quite well and the majority of candidates chose an appropriate scale for the protein content, plotted the bars correctly and labelled each bar. One common error here was to label the protein content axis without including units, or with incomplete units.
- (c) Candidates generally found this calculation challenging. Those who carefully worked through the three food items obtained the correct value of 42 g. As with all numerical questions, units must be included to gain full credit.

### Question 5

This question was intended to give candidates an opportunity to apply their knowledge and understanding of one of the core practicals to a given hypothesis, to describe how to present the results, to evaluate the investigation and to suggest further work to extend the study.

Whilst many candidates were able to describe a practical approach to the investigation, detailed accounts of presentation of the work and evaluation the investigation were less common.

In this question, it is important to separate out the different content of the answers. Part (a) relates to the method, part (b) to presentation and evaluation of the results and part (c) to the limitations and suggestions for further work. Some candidates included practical details in part (b), or suggested a table of results in part (c).

- (a) The majority of candidates were able to describe the method, at least in outline, for measuring light penetration, using a Secchi disc. It was also clear that many candidates understood the method of taking two readings and finding the mean value. There were some good, detailed accounts

suggesting first-hand knowledge of this activity, in which candidates described the use of a Secchi disc, or gave a description of the disc, a calibrated rope to measure the depth and taking readings on both sides of the island for the purposes of comparison. Relatively few candidates referred to the use of a compass to orientate the investigation and some did not include any safety precautions.

- (b) The candidates gained some credit in this part for indicating that the results should be tabulated. Credit was given here for either drawing a suitable table or for reference to tabulation of the data; further credit was given for meaningful headings, such as depth (with units), the sample number (for replicates) and for indicating that a mean value would be calculated.

In this part, candidates were also given credit for suggesting an appropriate way of presenting the results in a graphical form and some correctly suggested a bar chart, showing the mean light penetration on the east and on the west sides. Few candidates related the results to the original hypothesis and commented on the penetration of light in relation to the measured values.

- (c) This proved to be a challenging question. Candidates needed to include suitable limitations in their answer and to make acceptable suggestions for further work. Candidates were given credit for the sea conditions making it difficult to see the disc and therefore to determine the depth of light penetration accurately. Limitations should be based on genuine limits of the method, rather than ascribing limitations to errors made when carrying out the investigation. It may help candidates to address this part if they consider it in the form of the following question: "No matter how carefully I carried out the investigation, what other factors could cause variation in the results?"

Some candidates gained credit for extending the work by repeating the investigation at different time of the year, or on the other sides (north and south) of the island. Further work must be related to the original hypothesis, rather than describing a completely unrelated investigation.